Java Thread: How Threads Run

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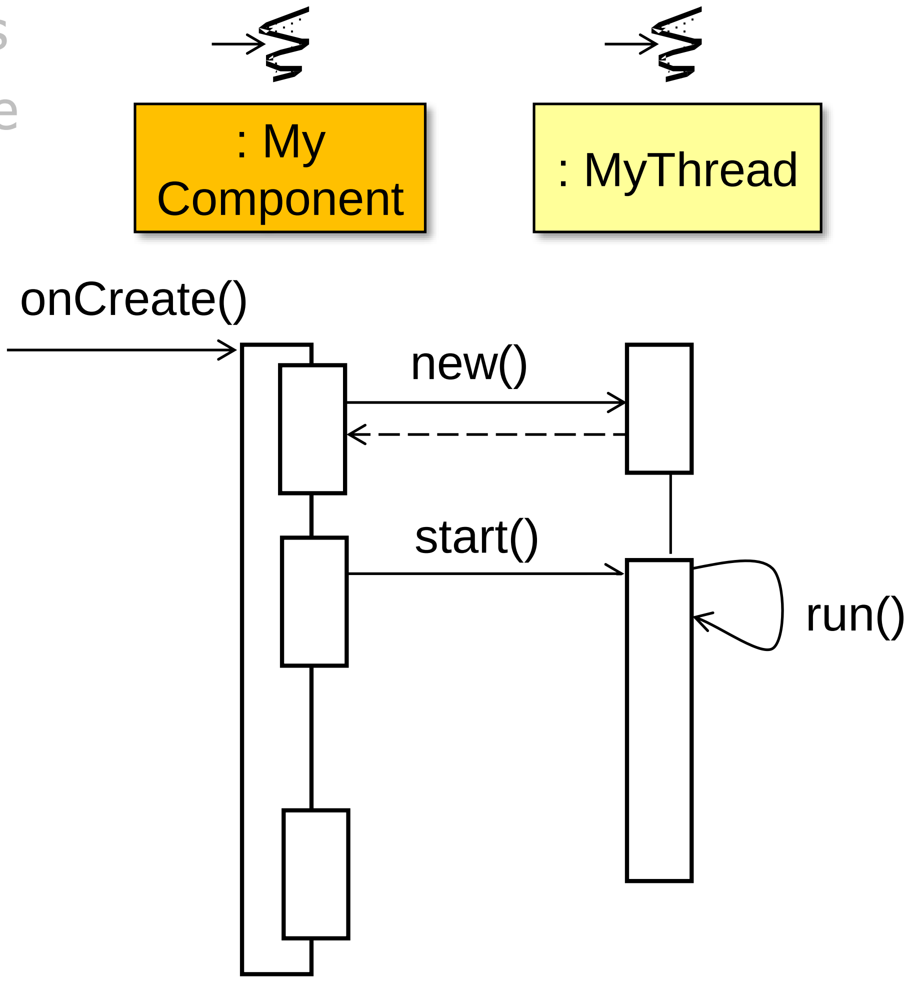
Learning Objectives in this Part of the Lesson

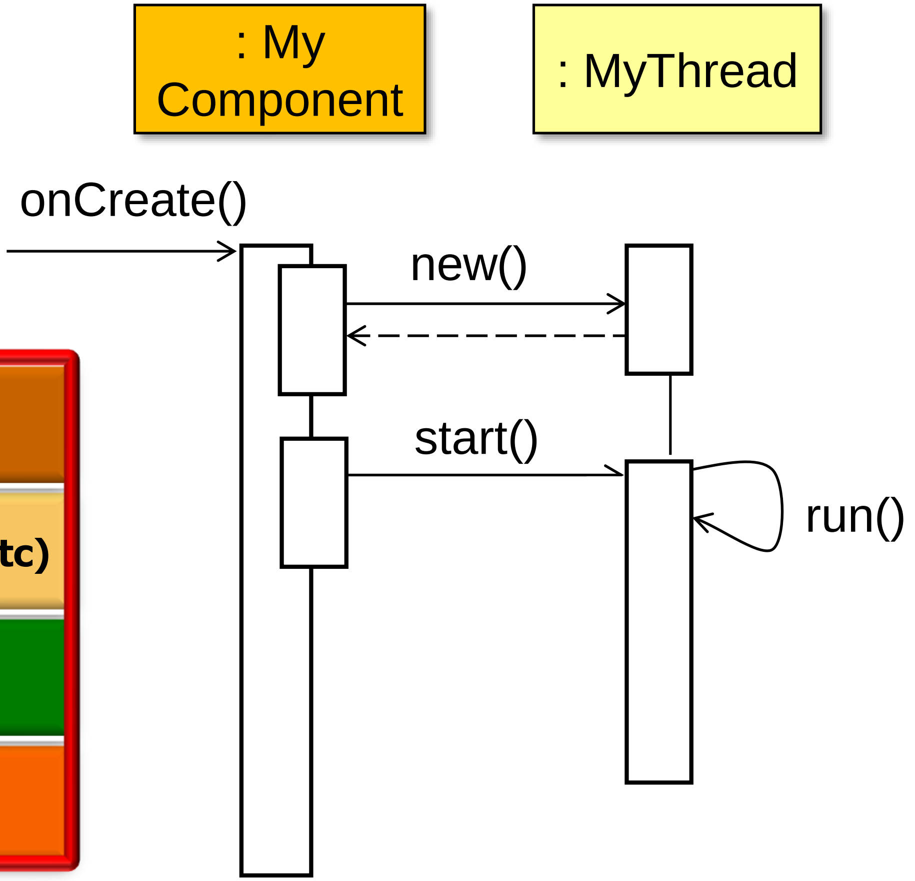
- Understand how Java threads support concurrency
- Learn how our case study app works
- Know alternative ways of giving code to a thread
- Learn how to pass parameters to a Java thread
- Know how to run a Java thread

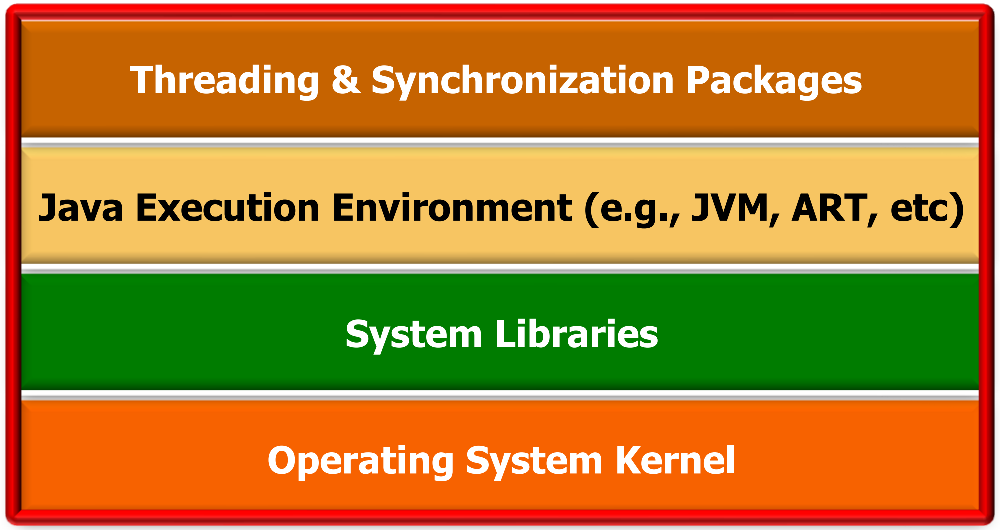


Running
Java Threads

Running Java Threads

- There are multiple layers involved in creating & starting a thread



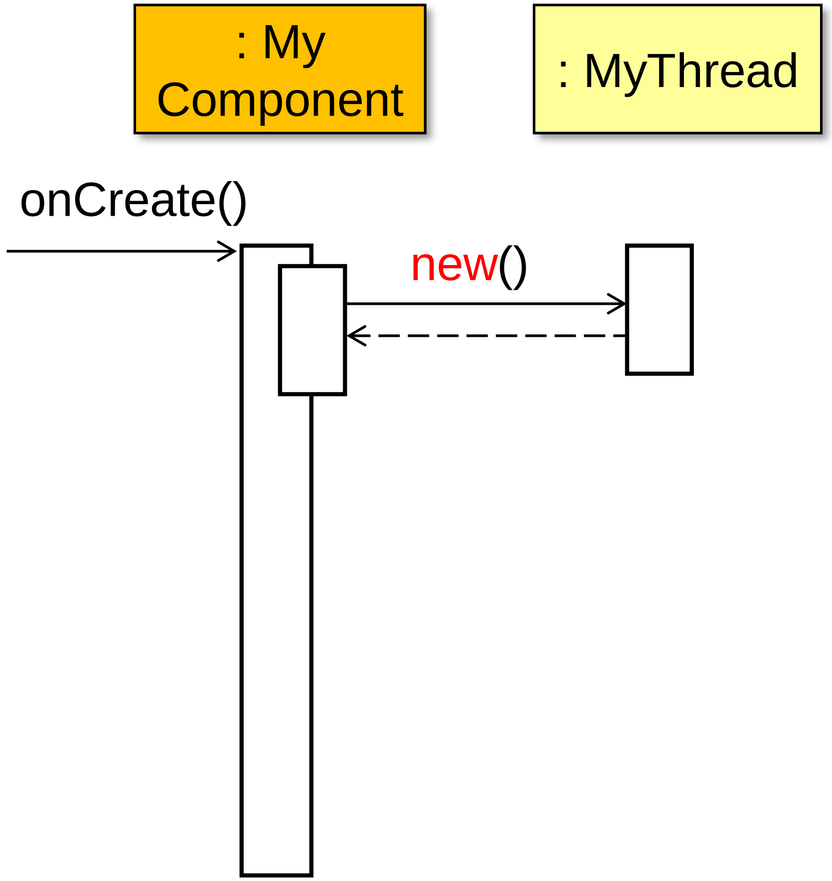


Threading & Synchronization Packages
Java Execution Environment (e.g., JVM, ART, etc)
System Libraries
Operating System Kernel

See the upcoming lessons on "*Managing the Java Thread Lifecycle*"

Running Java Threads

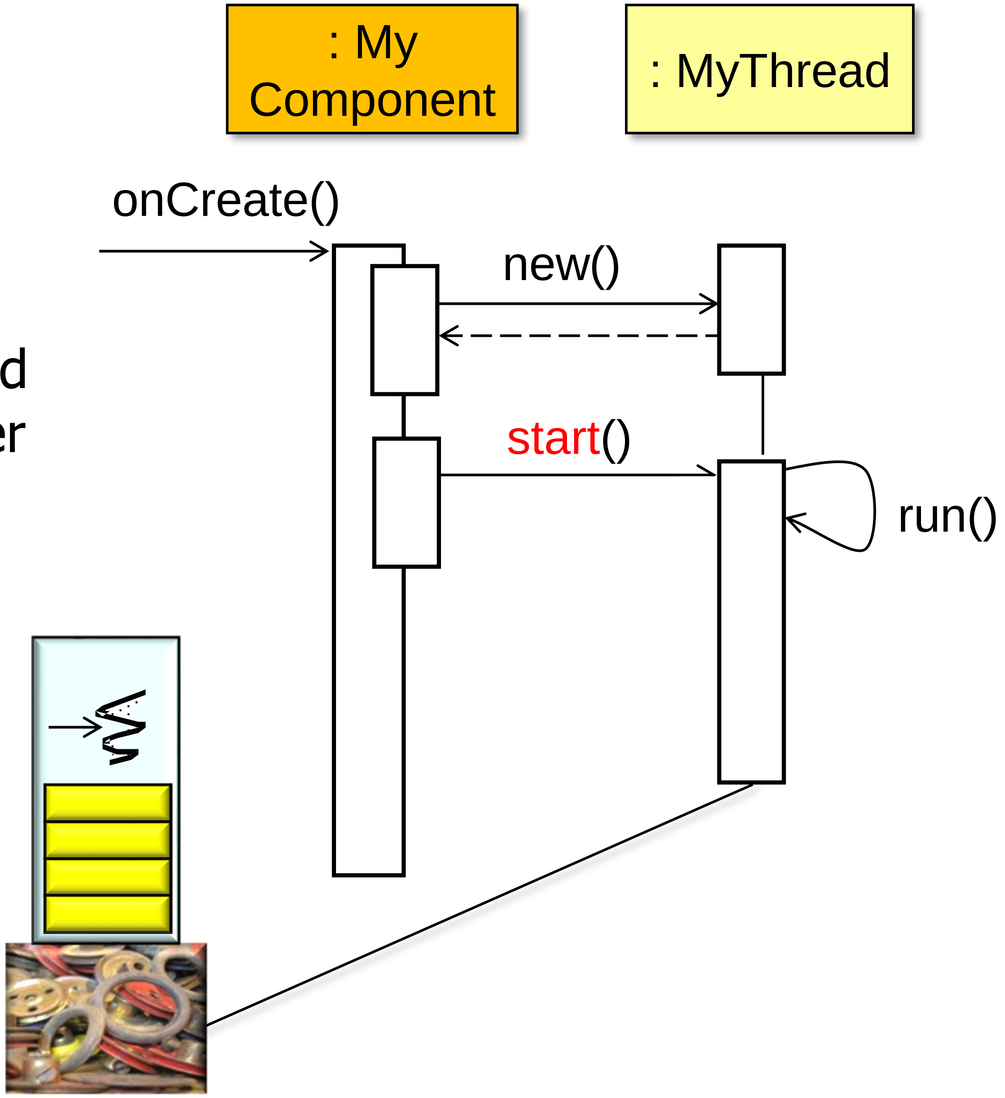
- There are multiple layers involved in creating & starting a thread
  - Creating a new thread object doesn't allocate a run-time call stack of activation records



See en.wikipedia.org/wiki/Call_stack

Running Java Threads

- There are multiple layers involved in creating & starting a thread
  - Creating a new thread object doesn't allocate a run-time call stack of activation records
  - The runtime stack & other thread resources are only allocated after the start() method is called



Running Java Threads

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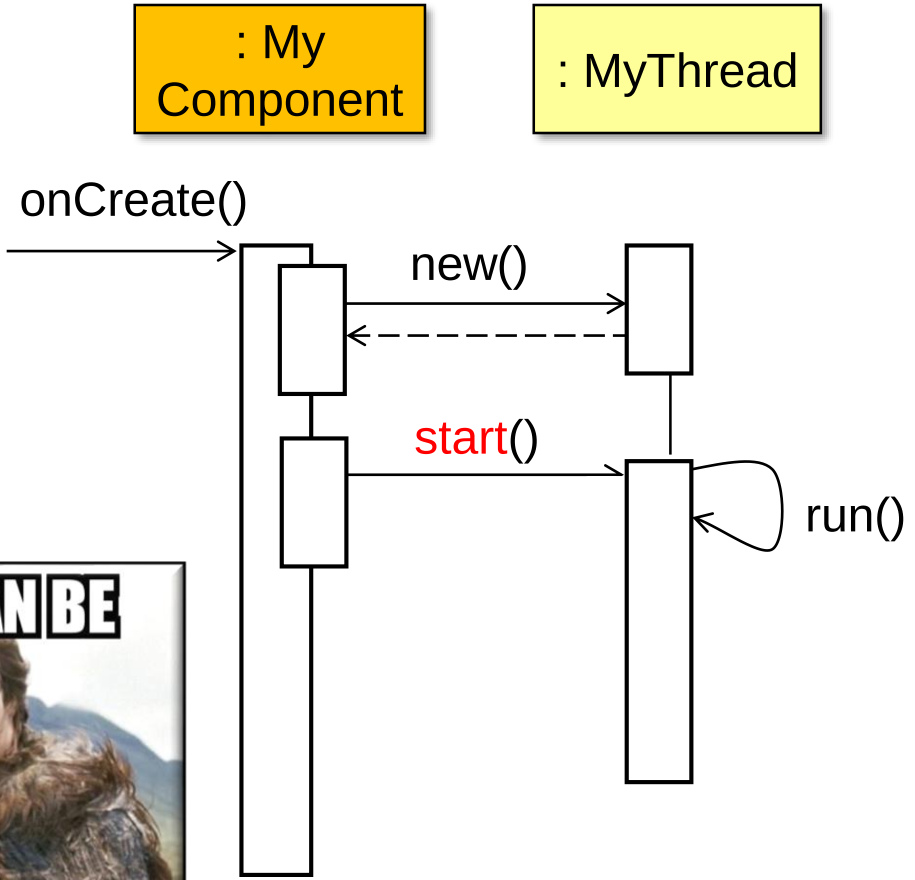
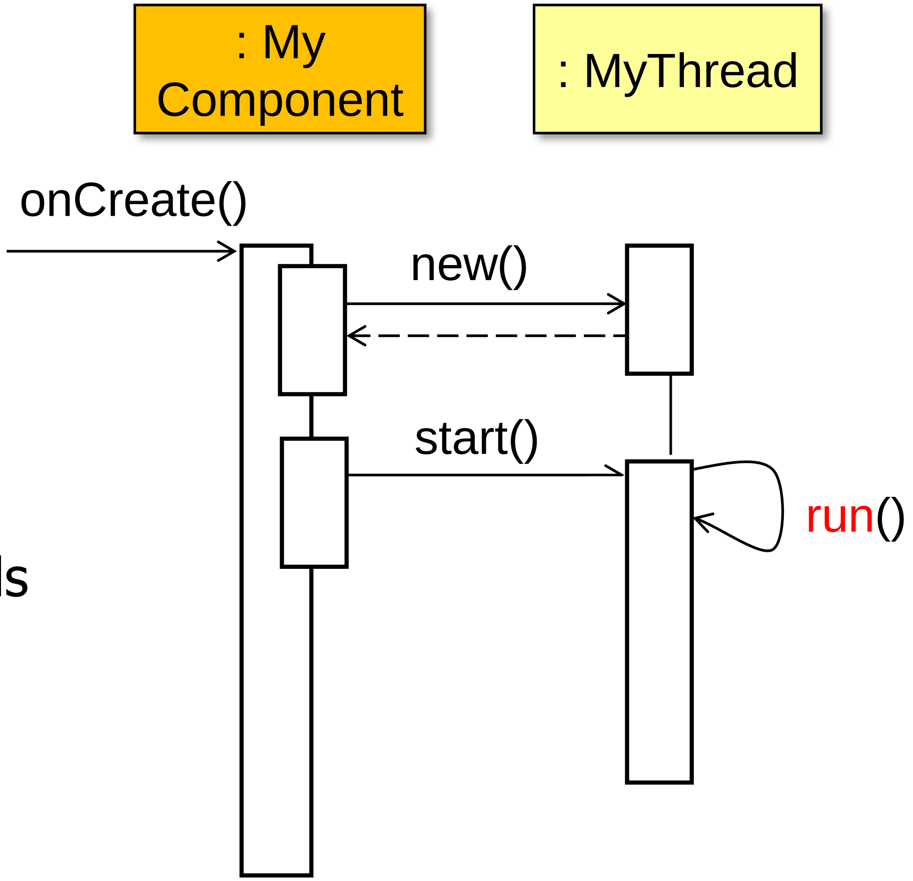


The start() method can only be called once per thread object

Running Java Threads

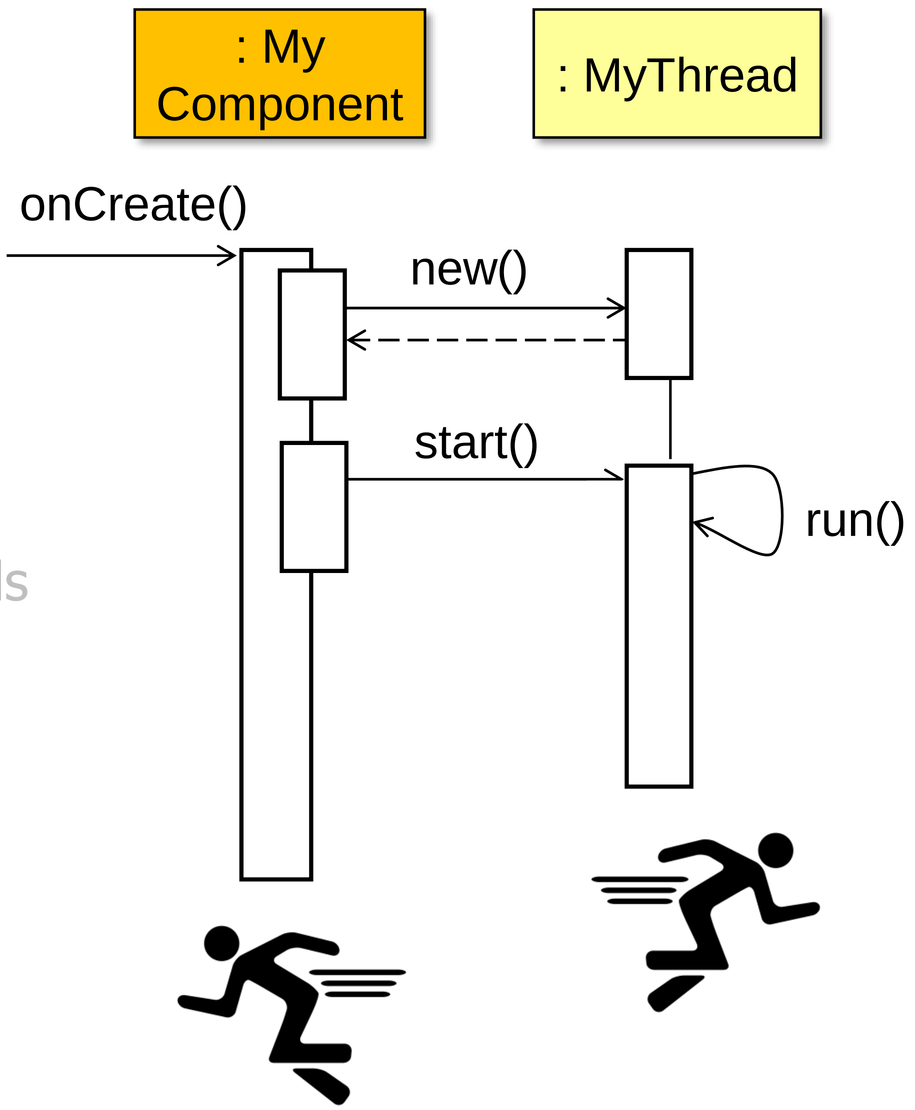
- There are multiple layers involved in creating & starting a thread
  - Creating a new thread object doesn't allocate a run-time call stack of activation records
  - The runtime stack & other thread resources are only allocated after the start() method is called
  - The Java execution environment calls a thread's run() hook method after start() creates its resources



See wiki.c2.com/?HookMethod

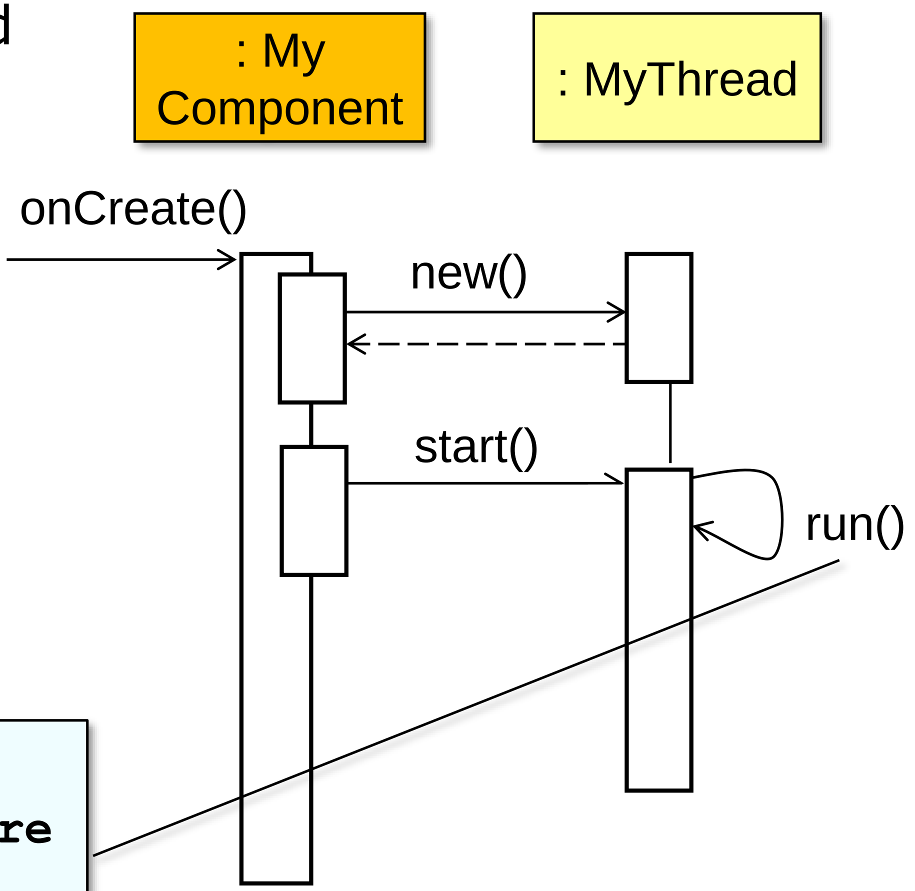
Running Java Threads

- There are multiple layers involved in creating & starting a thread
  - Creating a new thread object doesn't allocate a run-time call stack of activation records
  - The runtime stack & other thread resources are only allocated after the start() method is called
  - The Java execution environment calls a thread's run() hook method after start() creates its resources
  - Each thread can run concurrently & block independently



Running Java Threads

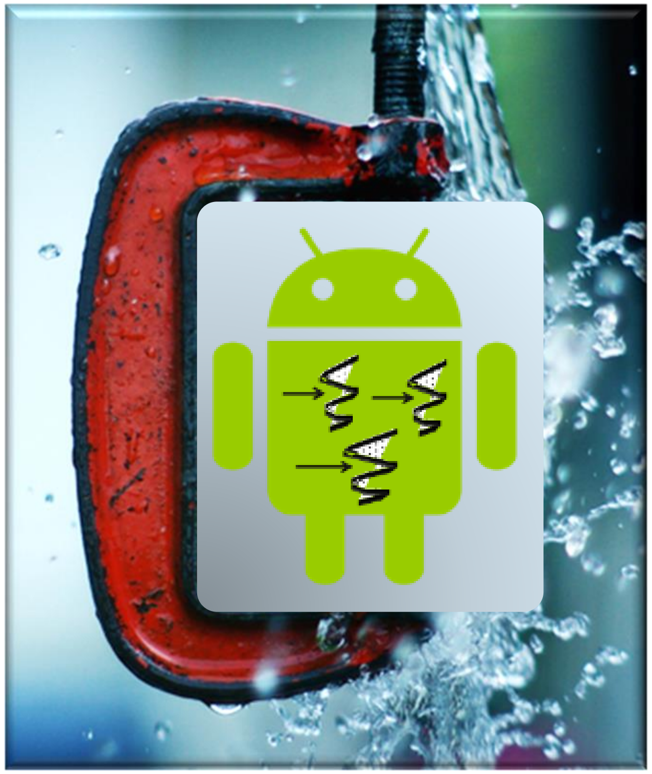
- Any code can generally run in a thread

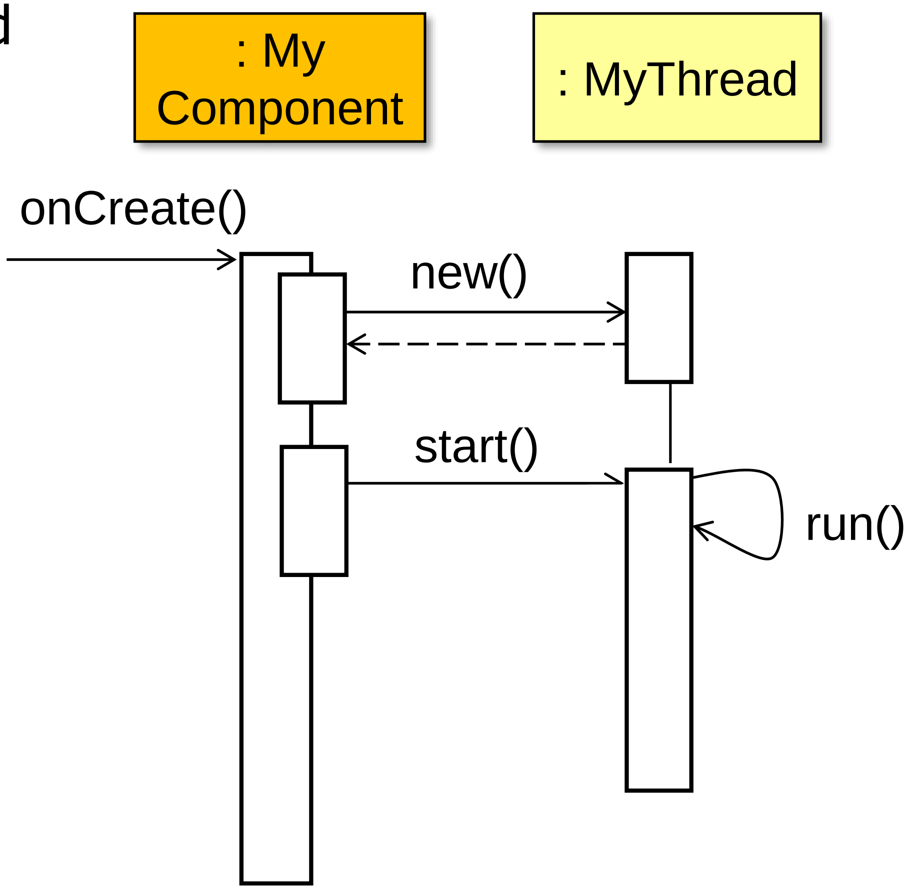


```
public void run(){
  // code to run goes here
}
```

Running Java Threads

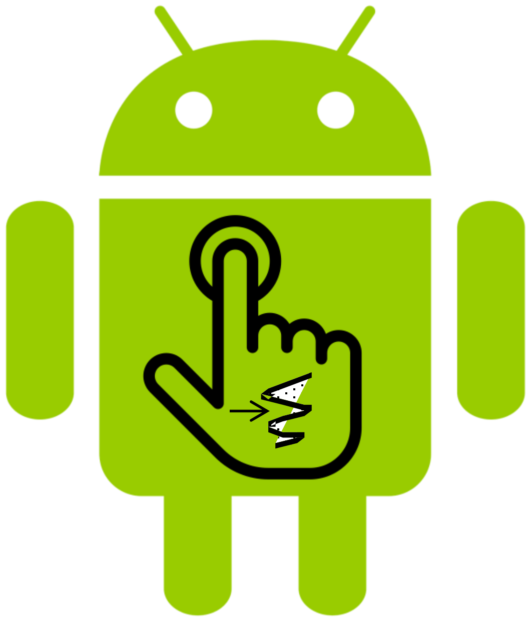
- Any code can generally run in a thread
  - However, windowing toolkits often restrict which thread can access GUI components

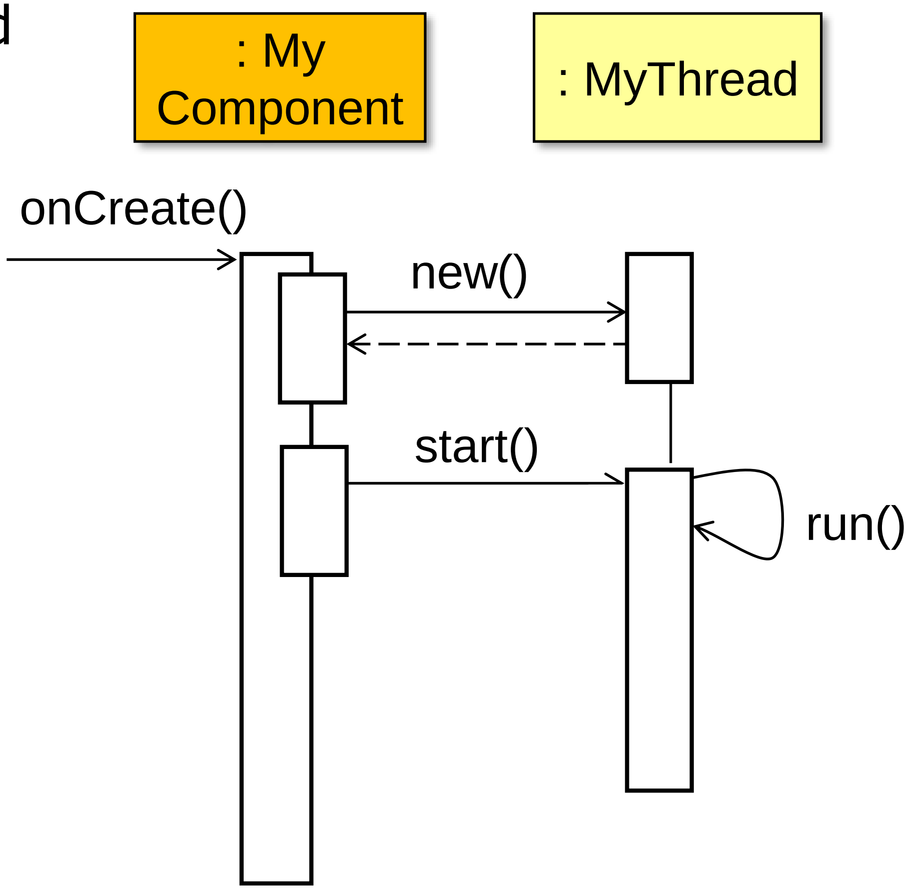




Running Java Threads

- Any code can generally run in a thread
  - However, windowing toolkits often restrict which thread can access GUI components
    - e.g., only the Android UI thread can access GUI components

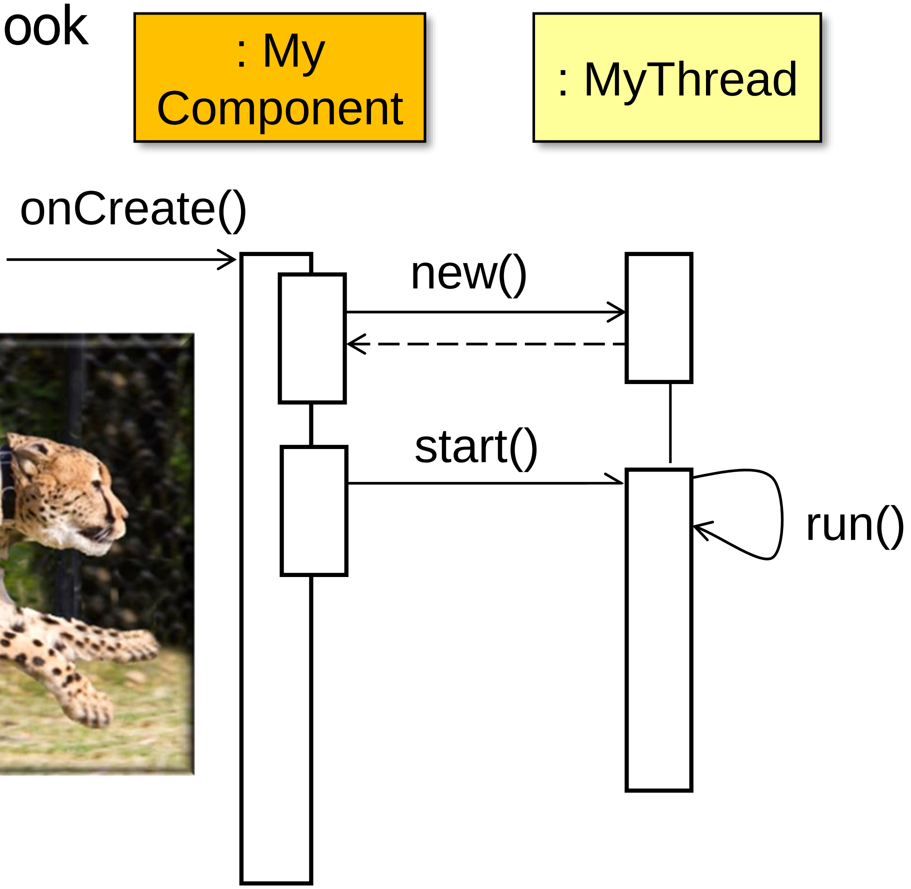




See developer.android.com/training/multiple-threads/communicate-ui.html

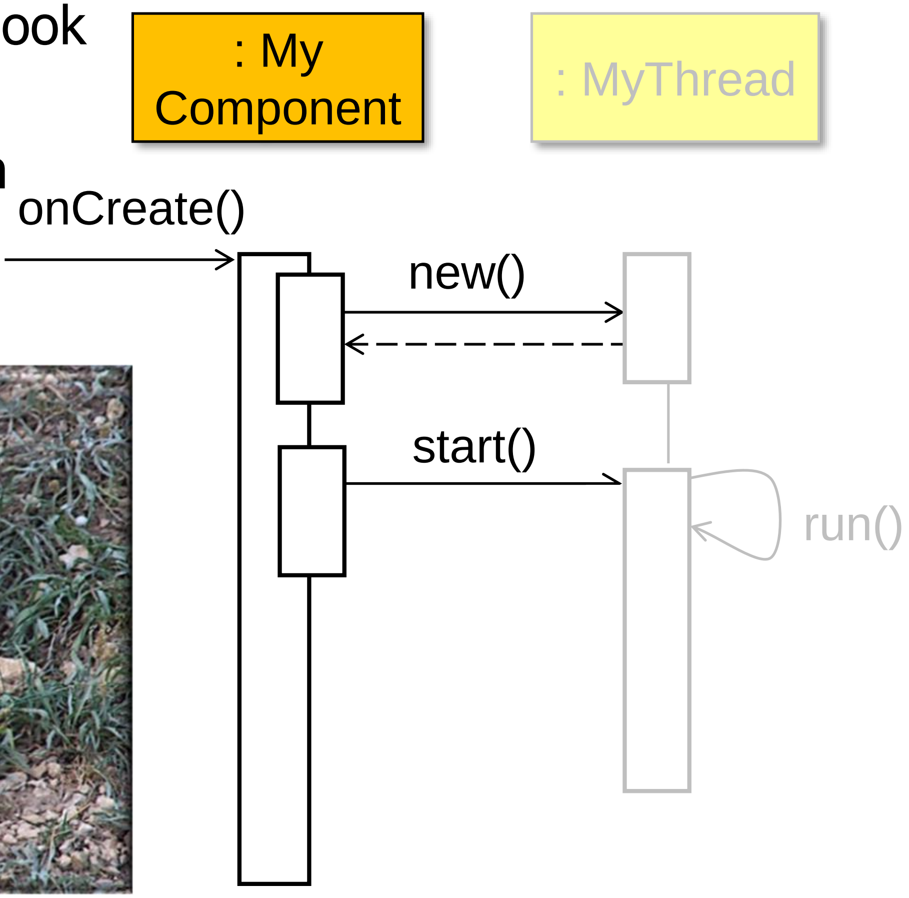
Running Java Threads

- A thread can live as long as its run() hook method hasn't returned



Running Java Threads

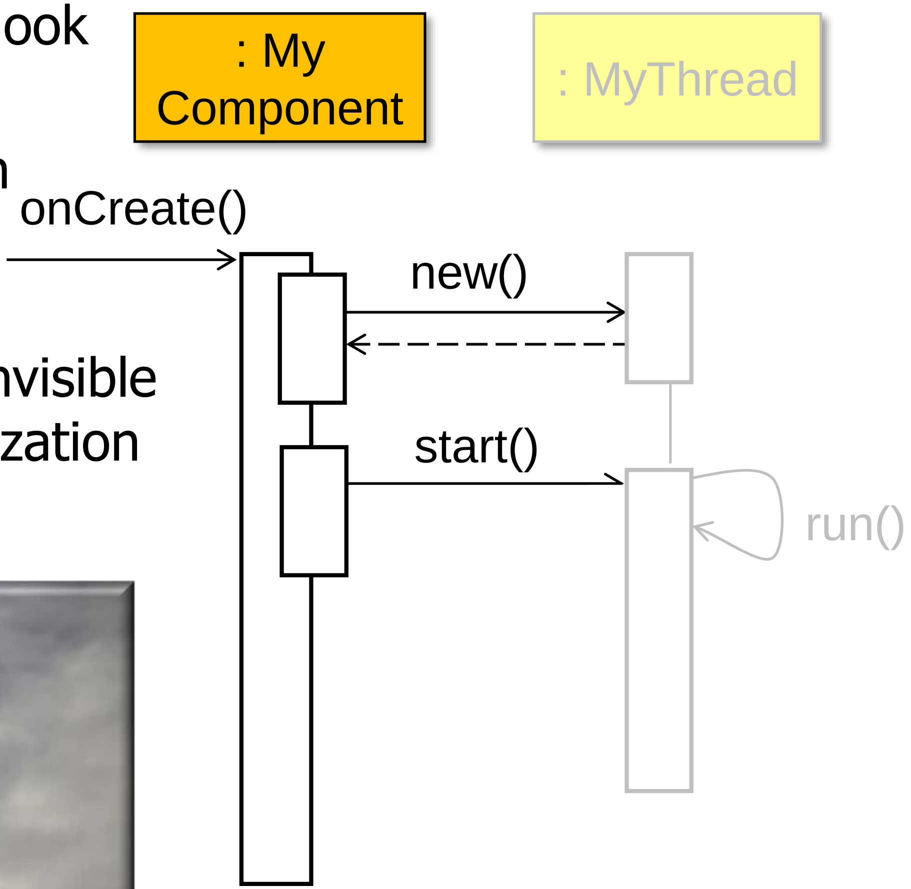
- A thread can live as long as its run() hook method hasn't returned
  - The underlying thread scheduler can suspend & resume a thread many times during its lifecycle



See en.wikipedia.org/wiki/Scheduling_(computing)

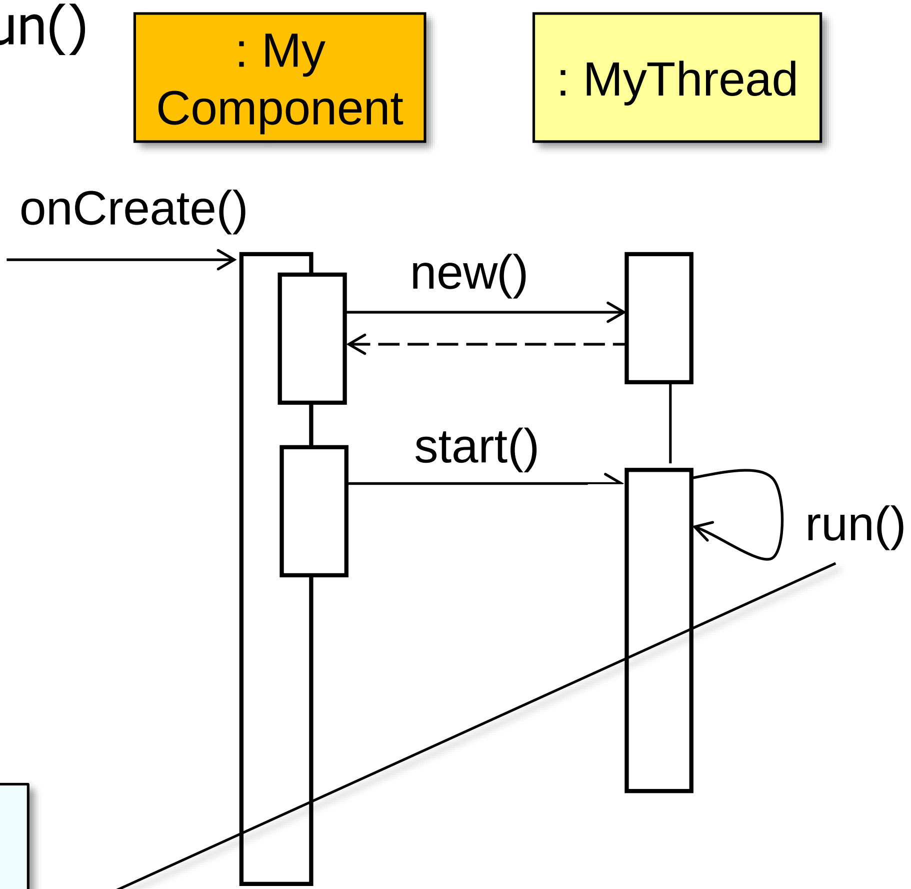
Running Java Threads

- A thread can live as long as its run() hook method hasn't returned
  - The underlying thread scheduler can suspend & resume a thread many times during its lifecycle
    - Scheduler operations are largely invisible to user code, as long as synchronization is performed properly..



Running Java Threads

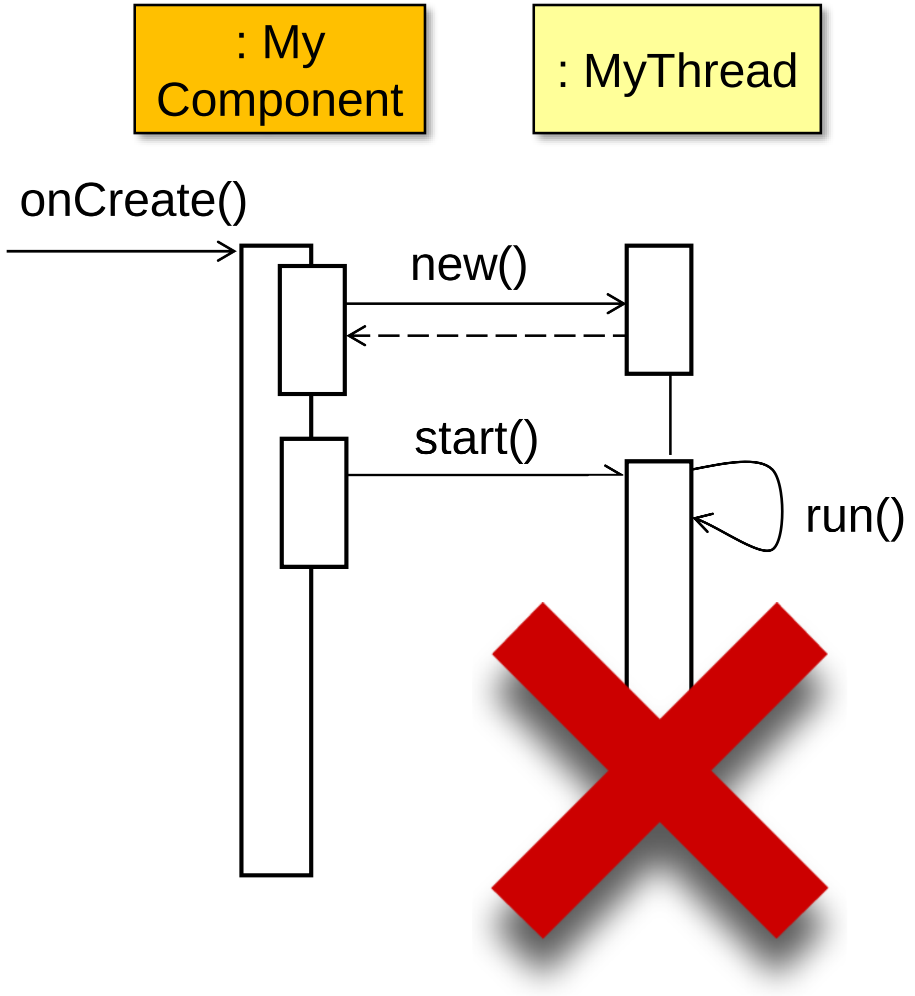
- For a thread to execute "forever," its run() hook method needs an infinite loop



```
public void run(){
  while (true) { ... }
}
```

Running Java Threads

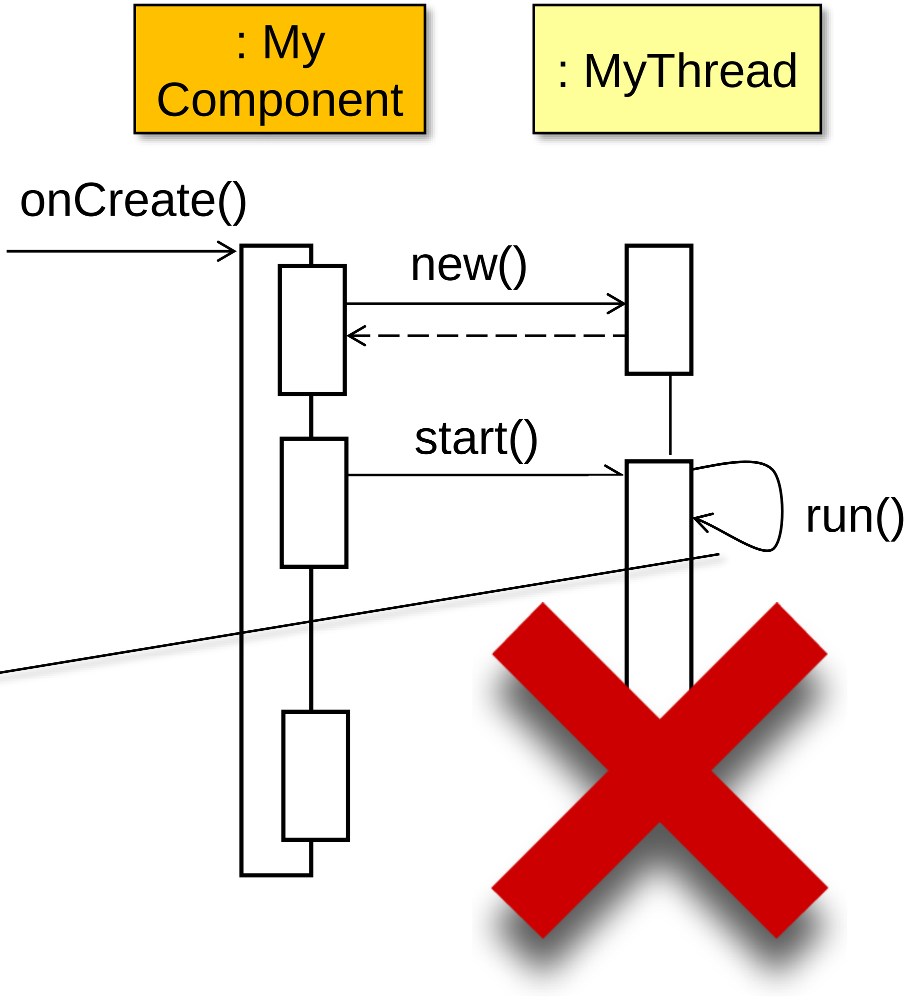
- The thread is dead after run() returns



Running Java Threads

- The thread is dead after run() returns
  - A thread can end normally

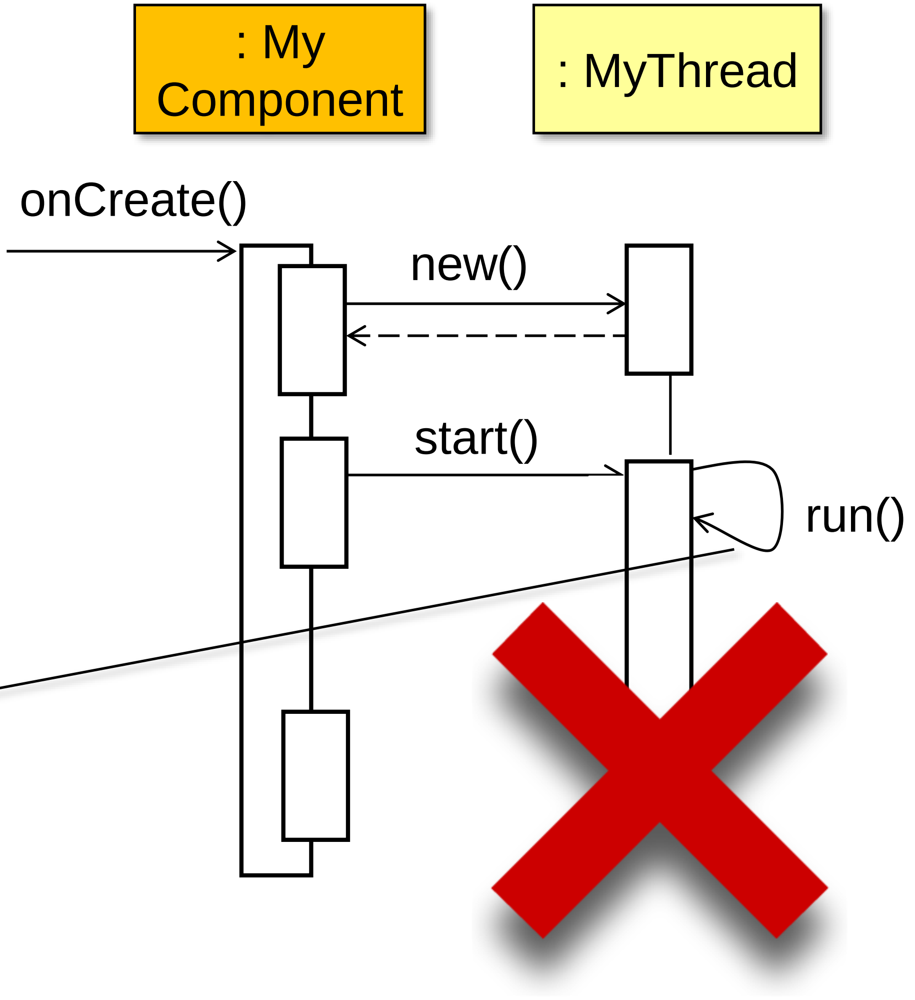
```
public void run(){
  while (true) {
    ...
    if (someCondition())
      return;
  }
}
```



Running Java Threads

- The thread is dead after run() returns
  - A thread can end normally
  - Or an uncaught exception can be thrown

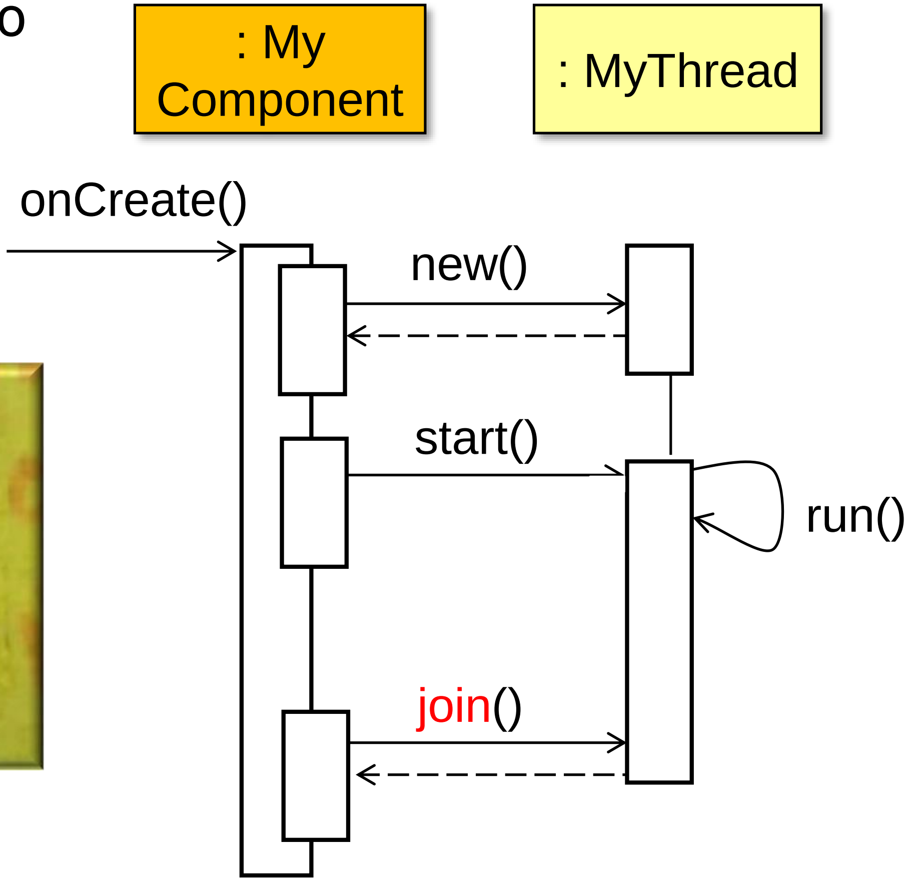
```
public void run(){
  while (true) {
    ...
    if (someError())
      throw new
        SomeException();
  }
}
```



See www.javamex.com/tutorials/exceptions/exceptions_uncaught_handler.shtml

Running Java Threads

- The join() method allows one thread to wait for another thread to complete



Running Java Threads

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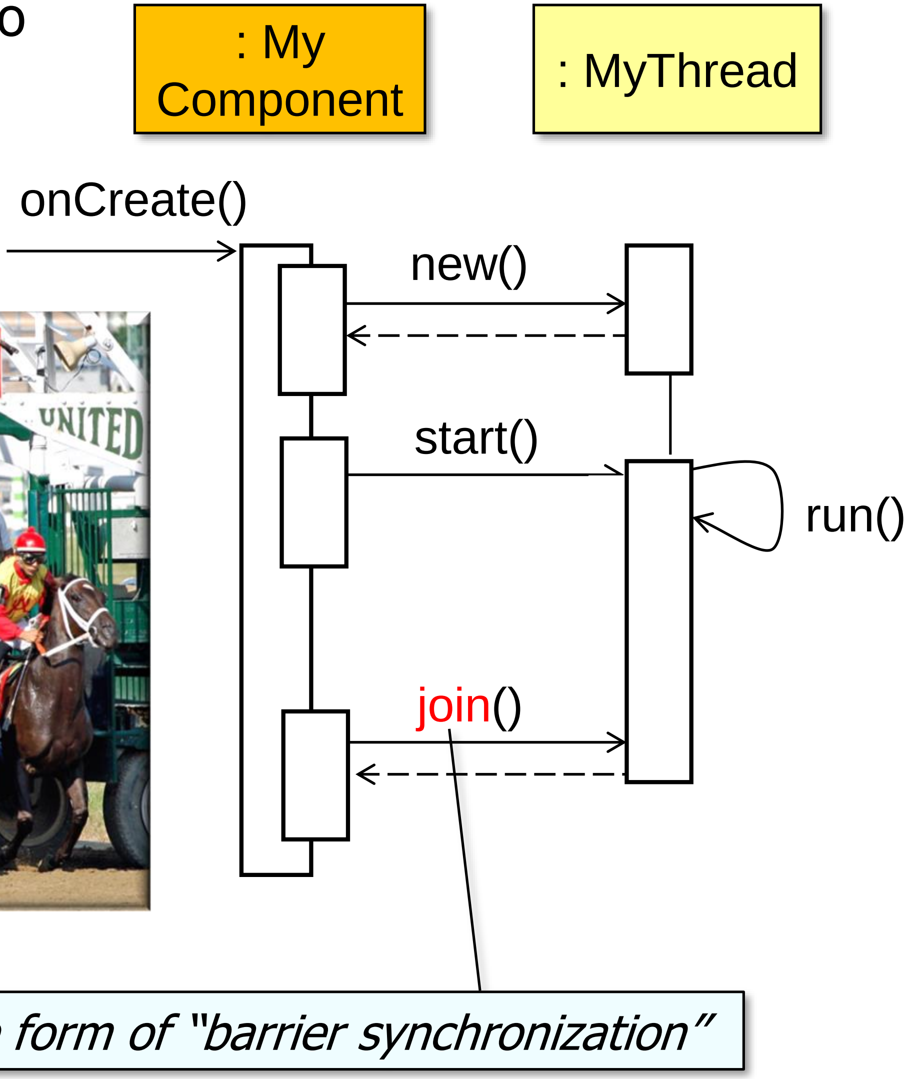
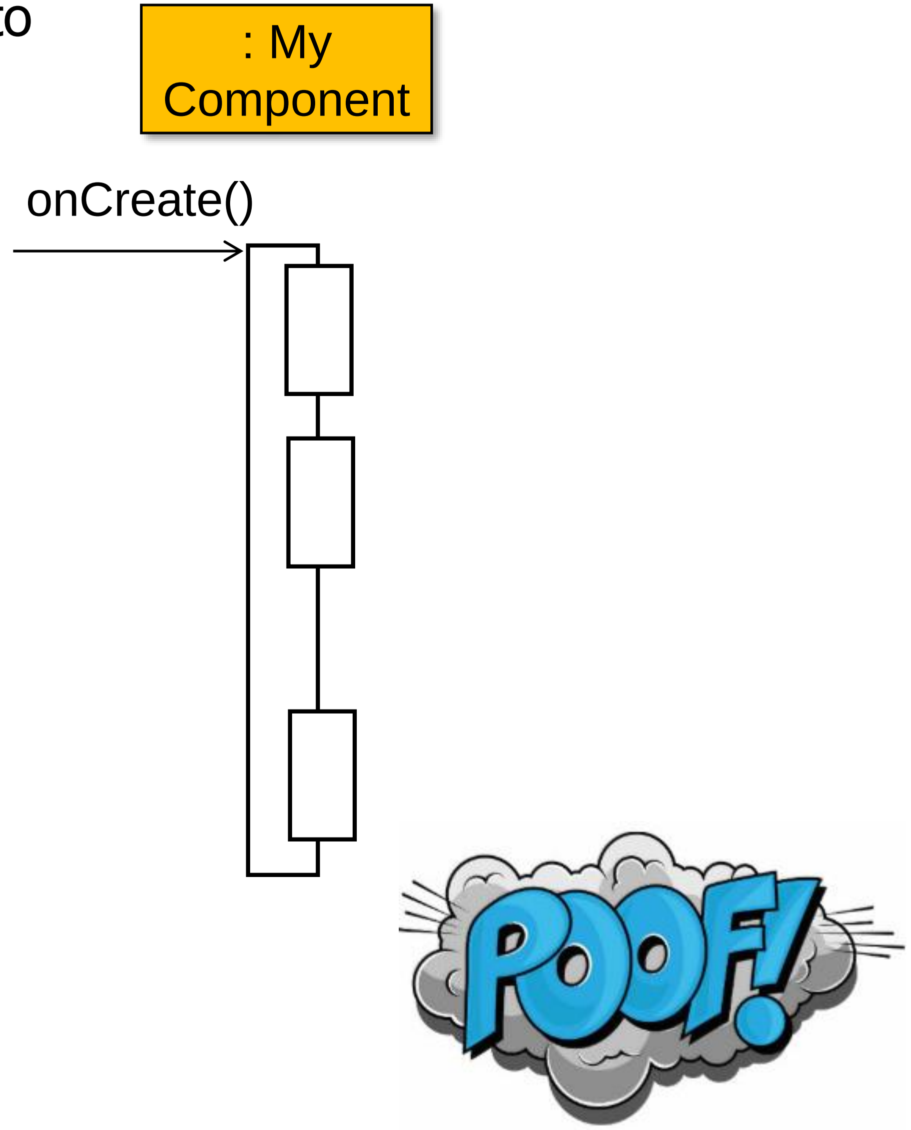


See upcoming lessons on "*Java Barrier Synchronizers*"

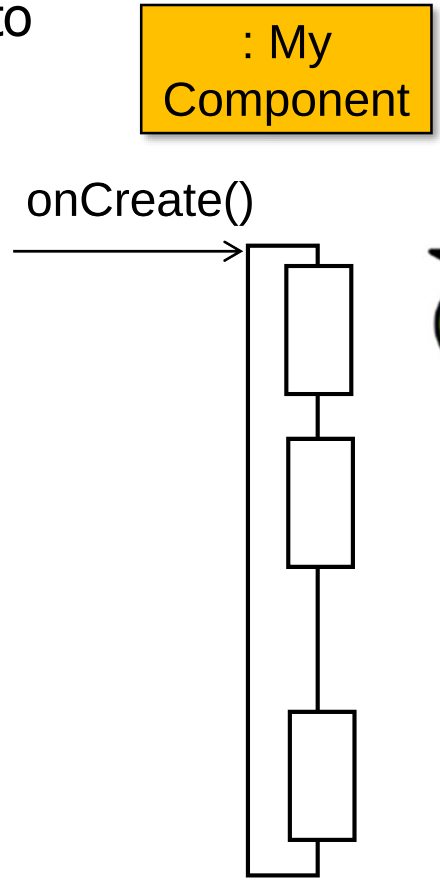
Running Java Threads

- The join() method allows one thread to wait for another thread to complete
  - Or a thread can simply evaporate!



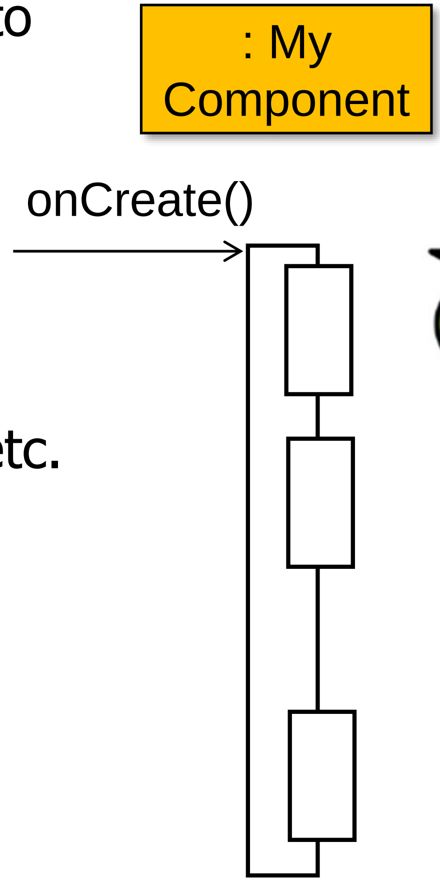
Running Java Threads

- The join() method allows one thread to wait for another thread to complete
  - Or a thread can simply evaporate!
  - The Java execution environment recycles thread resources



Running Java Threads

- The join() method allows one thread to wait for another thread to complete
  - Or a thread can simply evaporate!
  - The Java execution environment recycles thread resources
    - e.g., runtime stack of activation records, thread-specific storage, etc.



End of Java Thread: How Threads Run